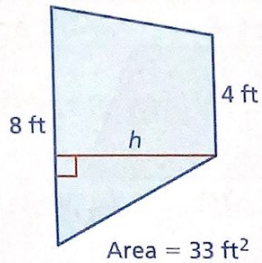
Example 3 Finding a Missing Dimension of a Trapezoid



Find the height of the trapezoid.

$A = \frac{1}{2}h(b_1 + b_2)$ Write formula for area of a trapezoid.

$33 = \frac{1}{2}h(4 + 8)$ Substitute 33 for A, 4 for b_1, and 8 for b_2.

$33 = \frac{1}{2}h(12)$ Add.

$33 = 6h$ Simplify.

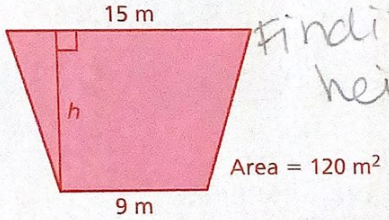
$\frac{33}{6} = \frac{6h}{6}$ Division Property of Equality

$5\frac{1}{2} = h$ Simplify.

▶ The height of the trapezoid is $5\frac{1}{2}$ feet.

Try It **Find the missing dimension of the trapezoid.**

5.



Finding height

$A = \frac{1}{2}h(b_1 + b_2)$

$120 = \frac{1}{2}h(15 + 9)$

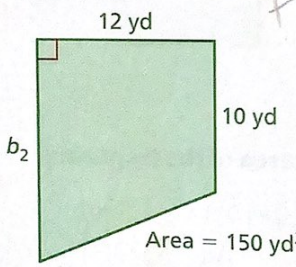
$120 = \frac{1}{2}h \cdot 24$

$120 = 12 \cdot h$

$\div 12$

$10\text{m} = h$

6.



Finding a base

$A = \frac{1}{2}h(b_1 + b_2)$

$150 = \frac{1}{2}(12)(10 + b_2)$

$150 = 6(10 + b_2)$

$150 = 60 + 6b_2$

-60

$90 = 6b_2$

$\div 6$

$15 = b_2$ yd

Try this then do #6

GO DIGITAL

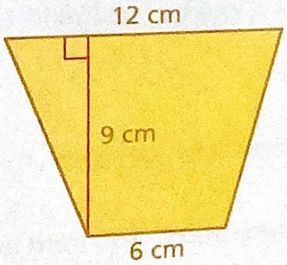
In-Class Practice

1 I don't understand yet. 2 I can do it with help. 3 I can do it on my own. 4 I can teach someone else.

7. **REASONING** What measures do you need to find the area of a trapezoid that has exactly one pair of parallel sides?

FINDING AREA **Find the area of the figure.**

8.



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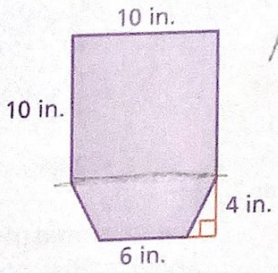


Go to pg 612
Square
$A = bh$
$10 \cdot 10$
100 in²

Trapezoid
$A = \frac{1}{2}h(b_1 + b_2)$
$\frac{1}{2} \cdot 4 (16)$
32 in²

$100 + 32$
132 in²

You Try

10. **FINDING A HEIGHT** The sum of the bases of a trapezoid is 20 inches. The area of the trapezoid is 50 square inches. What is the height of the trapezoid?

$50 = \frac{1}{2} \cdot h \cdot 20$

$50 = 10 \cdot h$

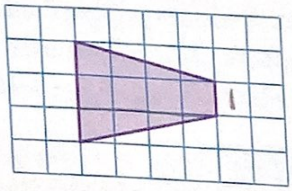
$\div 10$

Sixth h

Concepts, Skills, & Problem Solving

USING TOOLS **Find the area of the trapezoid by forming a parallelogram.** (See Exploration 1.)

8.



$b_1 = 1$

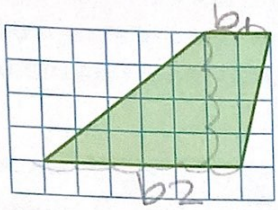
$b_2 = 3$

$h = 4$

$\frac{1}{2} \cdot 4 \cdot 4$

8 units^2

9.



$b_1 = 2$

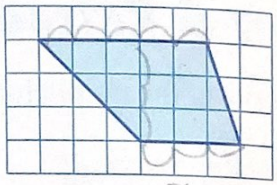
$b_2 = 6$

$h = 4$

$\frac{1}{2} \cdot 4 \cdot 8$

16 units^2

10.



$b_1 = 5$

$b_2 = 3$

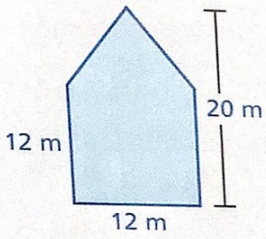
$h = 3$

$\frac{1}{2} \cdot 3 \cdot 8$

12 units^2

FINDING AREA **Find the area of the figure.** (See Example 1.) GO back to pg 608

11.



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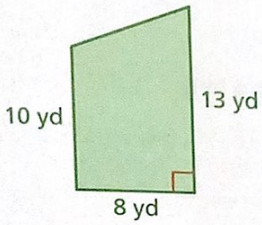
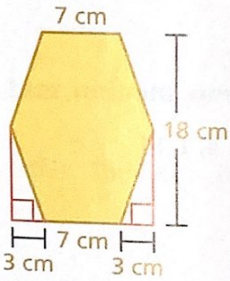


13.



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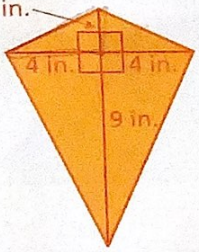


small triangle $A = \frac{bh}{2}$

$\frac{4 \cdot 2}{2}$

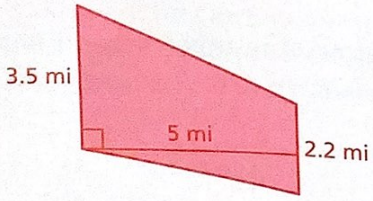
$= 4 \cdot 2 = 8 \text{in}^2$

big triangle $A = \frac{bh}{2}$

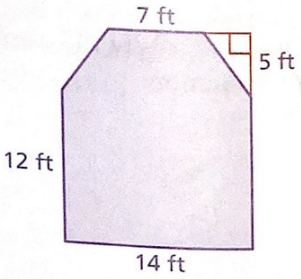
$\frac{4 \cdot a}{2} = 18 \cdot 2 = 36 \text{in}^2$

$8 + 36 = 44 \text{in}^2$

15.



16.

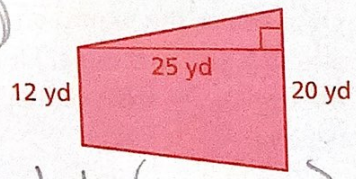


1 MTR HELP A CLASSMATE

Help a classmate find the area in Example 1(a) using a decomposition into two triangles.

Try It **Find the area of the figure.**

1.



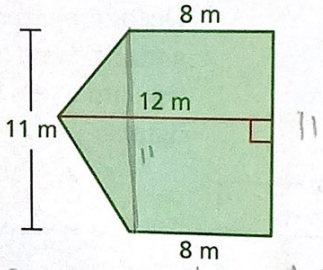
$A = \frac{1}{2}h(b_1 + b_2)$

$= \frac{1}{2} \cdot 25 \cdot 32$

$A = 400\ yd^2$

Not a trapezoid

2.



rectangle $A = bh$

$= 8 \cdot 11$

$= 88\ m^2$

triangle $A = \frac{bh}{2}$

$= \frac{11 \cdot 4}{2}$

$= 22\ m^2$

$22 + 88 = 110\ m^2$

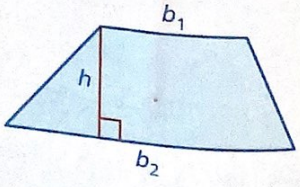
In Example 1(a), you could have used a copy of the trapezoid to form a parallelogram. As you may have discovered in the exploration, this leads to the following formula for the area of a trapezoid.

Key Idea

Area of a Trapezoid

Words The area A of a trapezoid is one-half the product of its height h and the sum of its bases b_1 and b_2.

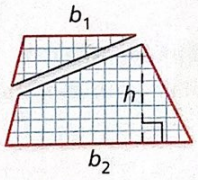
Algebra $A = \frac{1}{2}h(b_1 + b_2)$



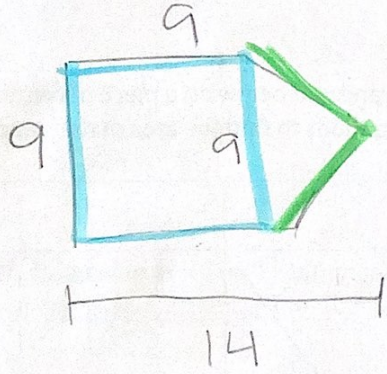
c. Draw *any* trapezoid that has exactly one pair of parallel sides on a piece of centimeter grid paper, and find its area. Explain your choice of method.

5 MTR MAKE A PLAN

How can you use the diagram below to justify the formula you wrote in part (d)?



d. Use your results to write a formula for the area A of a trapezoid that has exactly one pair of parallel sides. Does this formula work for trapezoids that have two pairs of parallel sides? Explain.



square $A = bh$

$A = 9 \cdot 9$

$= 81 \text{ in}^2$

triangle $A = \frac{bh}{2}$

$= \frac{9 \cdot 5}{2}$

$= 22.5 \text{ in}^2$

$81 + 22.5$

$A = 103.5 \text{ in}^2$